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USAS
X3.22-1967

USA Standard

Recorded Magnetic Tape for Information Interchange (800 CPI, NRZI)

American National Standard
This standard is one of more than 4000 approved as either a USA Standard or as an American Standard. It became an American National Standard in October 1969 when the Institute changed its name to American National Standards Institute, Inc.
ANSI, 1430 Broadway, New York, N.Y. 10018

X3.22-1967

This USA Standard was approved as a Federal Information Processing Standard by the President of the United States, Lyndon B. Johnson, on March 11, 1968.

Details concerning its applicability and use are printed in a National Bureau of Standards series of publications called *Federal Information Processing Standards Publications*. For a complete list of the publications in this series write to the Office of Technical Information and Publications, National Bureau of Standards, Washington, D.C. 20234.

USAS
X3.22-1967

USA Standard Recorded Magnetic Tape for Information Interchange (800 CPI, NRZI)

Sponsor
Business Equipment Manufacturers Association

Approved November 13, 1967
United States of America Standards Institute

USA Standard

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Published by

United States of America Standards Institute

10 East 40th Street, New York, N. Y. 10016

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Universal Decimal Classification 681.3

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Printed in USA

A7.5M 1168/250

Foreword

(This Foreword is not part of USA Standard Recorded Magnetic Tape for Information Interchange, (800 CPI, NRZI), X3.22-1967.)

This standard presents the standard technique for recording the USA Standard Code for Information Interchange, X3.4-1967 (USASCII), or the latest revision thereto, on magnetic tape at 800 CPI (characters per inch) using NRZI (nonreturn-to-zero—change on ones) recording techniques. It is one of a series of standards implementing the USASCII in media.

Subsequent standards will specify higher densities and will define more fully the physical and magnetic properties of magnetic tape.

Work is continuing on definitions, higher performance, and future requirements.

The X3.2.1 Task Group which developed this document consists of a group of experienced and qualified specialists on recording of digital information on magnetic tape.

In the development of this standard careful consideration was given to current practices, existing equipment and supplies, and the broadest possible acceptance, while providing a basis for future improvement in the use of the medium.

This standard was approved as a USA Standard by the United States of America Standards Institute on November 13, 1967.

Suggestions for improvement derived from the use of this standard will be welcome. They should be sent to the United States of America Standards Institute, 10 East 40th Street, New York, New York 10016.

The USA Standards Committee on Computers and Information Processing, X3, at the time this standard was approved had the following membership:

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At the time the proposal was developed and processed through the X3.2 Subcommittee on Codes and Input-Output, the membership was:

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It should be recognized that although X3.2 and X3.2.1 members are variously affiliated, work on a subcommittee or task group is achieved on an individual competence and experience basis.

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USA Standard Recorded Magnetic Tape For Information Interchange (800 CPI, NRZI)

1. Scope

This standard is intended to provide a format and recording standard for ½-inch 9-track magnetic tape and reels to be used for information interchange among information processing systems, communication systems, and associated equipment, utilizing the USA Standard Code for Information Interchange, X3.4-1967 (USASCII), or the latest revision thereto.

2. Tape

2.1 Material. The tape shall consist of a base material of polyester film (oriented polyethylene terephthalate film or equivalent) coated on one side with a durable yet flexible layer of ferromagnetic material dispersed in a suitable binder.

2.2 Physical Dimensions.

2.2.1 Tape width: 0.498 ± 0.002 inch

2.2.2 Tape thickness: 0.0019 ± 0.0003 inch

2.2.3 Base material thickness: 0.00142-inch nominal

2.2.4 Coating thickness: 0.0006-inch max

2.2.5 Tape length: 2,500-feet max

2.3 Physical Requirements. Magnetic oxide surface shall be free of raised areas, holes, or any foreign matter, and the surface of the base material must be free of powder or accumulation of deleterious matter which could cause incorrect operation or necessitate increased servicing of the tape transports. Tapes are not to be spliced; special leaders or trailers may be attached to the tape.

3. Tape Reel

3.1 Reels shall be constructed such that any profile section taken through the center axis of the reel conforms to Fig. 1, except where taken so as to pass through the relieved portion of the write-enable ring groove. The section shall, in this case, conform to the profile of Fig. 1 with appropriate deviations permitted at the ring groove relief as illustrated in the detail of Fig. 2.

3.1.1 All dimensions shown in Figs. 1 and 2, including those in detail sections, shall be held to the tolerances specified in Table 1.

Table I
Tape Reel Tolerances

Dimension	Nominal, inches*	Tolerance, inches*
A	3.688	+ 0.005 − 0.003
B	10.500	± 0.020
C	5.125	± 0.005
D	3.875	± 0.005
E	4.388	± 0.005
F	0.250	+ 0.010 − 0.000
H	0.750	± 0.015
J	0.102	Max
K_F	0.125	Max
K_R	0.080	Max
L	4.125	Min
M	0.718	± 0.005
P	4 degrees	± 15 minutes of arc
R	1.677	± 0.010

*Except where otherwise noted.

3.1.2 Thickness of the flange portion of reels may be varied but must fall entirely within the cross-hatched envelopes defined by dimensions J, K_R, K_F, and M.

3.1.3 Hub and flanges need not be integral but may be separate parts at the manufacturer's option as long as all of the other requirements of this standard are met.

3.1.4 Bosses, ribs, or raised designs are permitted on the outside surfaces of the flanges, providing they do not extend beyond the cross-hatched envelope of Fig. 1.

3.2 Flanges must have holes to permit threading tape onto the hub unless a suitable alternative method of thread-up is provided.

3.2.1 Size and shape of flange holes shall be optional, having such a minimum dimen-

Fig. 1
Tape Reel Sectional View

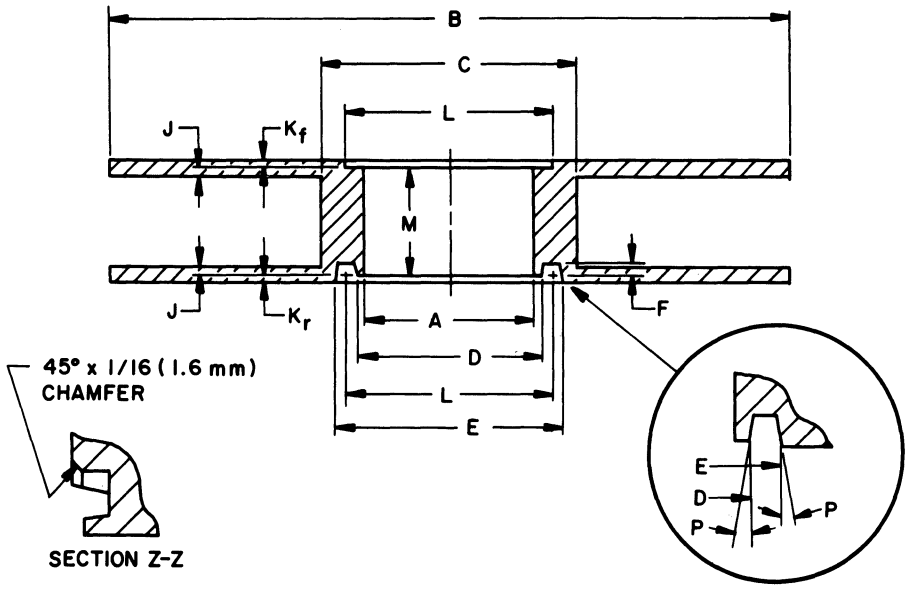
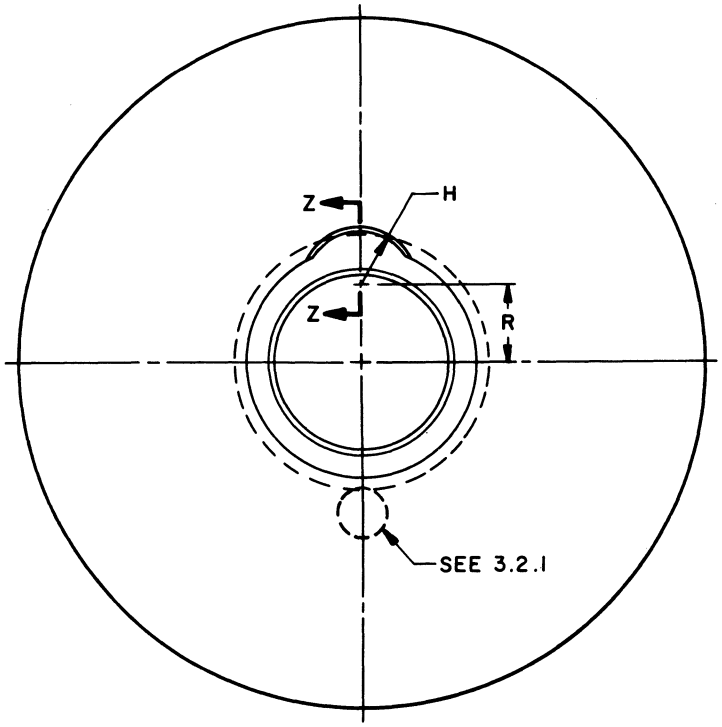


Fig. 2
Tape Reel



sion as not to inhibit the usual technique of manual threading.

3.3 Reels may be constructed from any suitable material or materials so long as the dimensional and inertial requirements of this standard are maintained.

3.4 Reels are not symmetrical, the flanges differing primarily as to the presence or absence of the write-enable ring groove, which must be adjacent to the mounting pedestal for correct machine operation.

3.5 The outside cylindrical surface of the hub shall be concentric with the center bore (dimensions *C* and *A*, respectively, of Fig. 1) within 0.010 inch.

3.6 Dimension *A* shall not reduce below 3.678 in. when loaded with a full reel of tape wound at 0.75-lb constant tension.

3.7 Moment of inertia of the reel is not a criterion. The combination of tape and reel must not exceed 0.091 in. · lb · s^2. In general, this will require a reel which does not exceed 0.022 in. · lb · s^2.

3.8 Dimension *L* (Fig. 1) defines reel mounting surface. The ring groove relief (Fig. 2) is not required so long as the ring type designated for that reel does not protrude beyond the reel mounting surface.

4. Recording Area Markers

Each reel of tape shall be furnished with two photo reflective markers, beginning-of-tape (BOT) and end-of-tape (EOT), as in Fig. 3.

5. Recording

5.1 Method. The recording method shall be NRZI (nonreturn-to-zero — change on one). A "1" bit is produced by reversal of flux polarity.

5.2 Density—800 CPI (Characters Per Inch) Nominal. The equipment used for recording tapes at 800 CPI must be capable of recording at the nominal character spacing of 1250 μin. (microinches) $\pm$ 3 percent. This capability shall be measured over a 150-inch minimum length of tape which has been recorded continuously with 800 in-phase flux reversals per inch in all tracks.

5.3 Skew. Skew is defined as the deviation during reading of the bits within the recorded character from time coincidence (converted to apparent length) when measured at a point immediately beyond the digitizing detector.

5.3.1 ***Static Skew.*** The equipment used for recording tapes at 800 CPI must be capable of recording 150 μin. or less of absolute static skew. This capability shall be measured on a tape which has been recorded continuously with 800 in-phase flux reversals per inch in all tracks. This maximum static deviation within a character is the value of static recorded skew. Both character polarities must meet the criterion.

5.3.2 ***Write Quality.*** After writing an 800 CPI interchange tape, initial reading (either write check or read) on the same equipment determines bit timing (converted to microinches) and signal amplitude.

5.3.2.1 *Bit Timing.* To determine bit timing, from leading edge to leading edge, the following conditions must be considered together. It is not required that each character recorded on tape be checked for conformance to these parameters but that the hardware be designed and maintained in such a manner as to assure meeting these conditions:

(1) The timing between the first detected bit of successive characters is nominally measured greater than 900 μin.

(2) The timing between the first detected bit and the last detected bit of a character is nominally measured less than 425 μin.

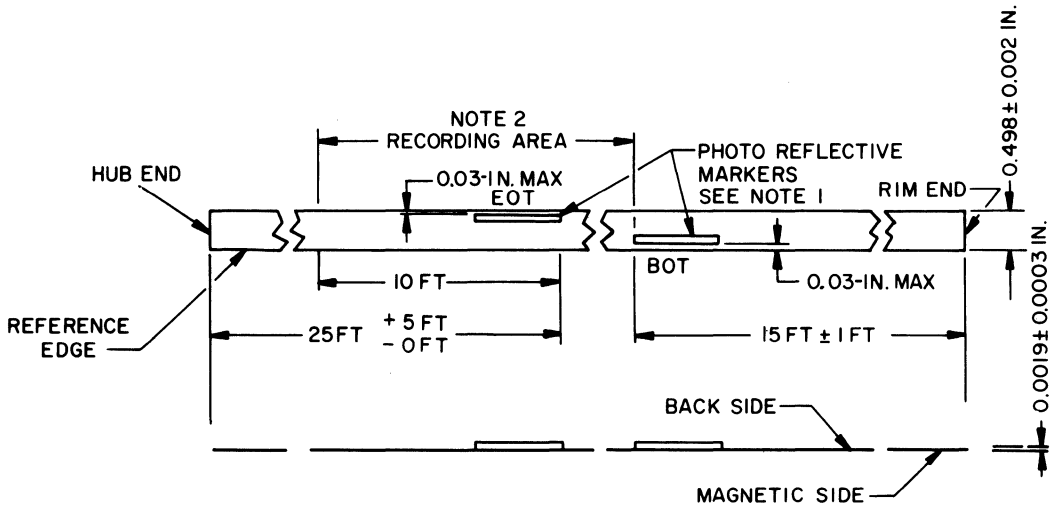
5.3.2.2 *Signal Amplitude.* No "1" bit amplitude level shall be less than 35 percent of the average "all 1's" signal level on that initial reading.

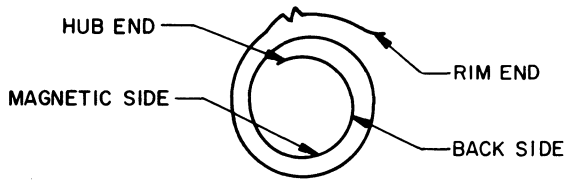
5.4 Erase.

5.4.1 ***Erase Direction.*** The tape shall be magnetized so that the rim end of the tape is a north seeking pole.

5.4.2 ***Erase Width.*** The full width of the tape is DC erased in the direction specified in 5.4.1.

Fig. 3
Tape Markers, Recording Area, and Tape Wind

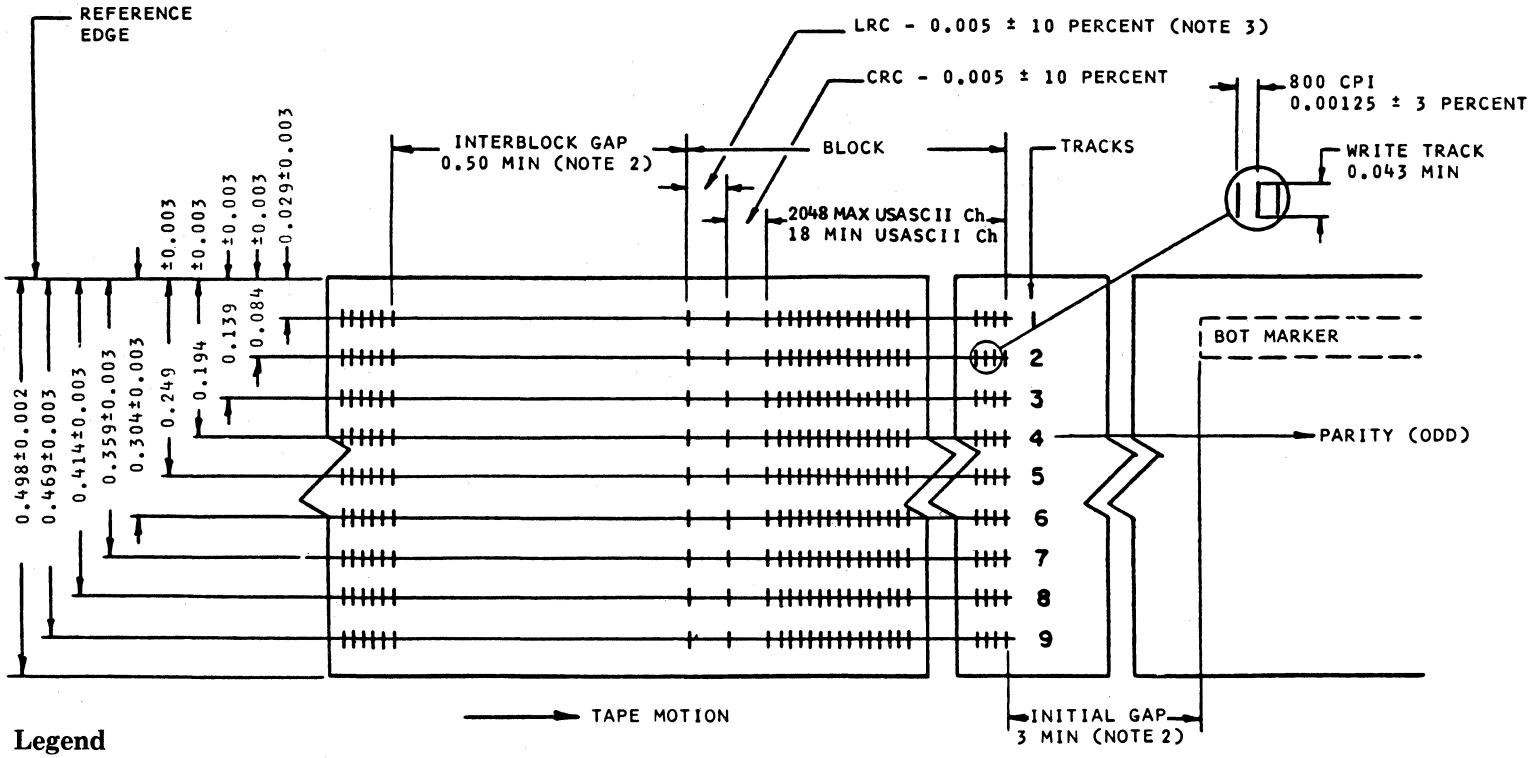




FRONT VIEW
SCHEMATIC OF TAPE WINDING

NOTES:
(1) Photo reflective markers shall not protrude beyond edge of tape and shall be free of wrinkles and excessive adhesive. Marker dimensions: length, 1.2 ± 0.2 inch; width, 0.19 ± 0.02 inch; thickness, 0.0005 ± 0.0001 inch.
(2) Minimum for test area; maximum for recording.
(3) Tape shall not be attached to the hub.

Fig. 4
Recording Format
(800 CPI)



Legend

CPI	tape characters per inch
Ch	characters
MIN	minimum
MAX	maximum
BOT	beginning of tape
LRC	logitudinal redundancy check
CRC	cyclic redundancy check

NOTES:

(1) Tape is shown with oxide side up, Read/Write head on same side as oxide. Tape shown representing "1" bits in all NRZI recording; "1" bit produced by reversal of flux polarity, tape fully saturated in each direction.

(2) Tape to be fully saturated in the erased direction in the interblock gap and the initial gap.

(3) A longitudinal redundancy check bit is written in any track if the longitudinal count in that track is odd. Character parity is ignored in the longitudinal redundancy check character.

(4) CRC — Parity of CRC character is odd, if an even number of data characters are written, and even, if an odd number of characters are written.

(5) All dimensions are given in inches.

6. Format (Fig. 4)

6.1 Nine Parallel Tracks.

6.2 Track Dimensions.

6.2.1 Track width on tape is 0.043-inch min.

6.2.2 Centerline distance between tracks is 0.055 inch nominal.

6.2.3 Centerline of Track 1 is to be 0.029 ± 0.003 inch from reference edge.

6.3 Reference Edge. The reference edge of the tape shall be the top edge when viewing the oxide coated side of the tape with the beginning of the record to the observer's right. See Fig. 4.

6.4 Track Identification. Tracks shall be numbered consecutively, beginning at the reference edge with Track No. 1, and assigned as follows:

Track:	1	2	3	4	5	6	7	8	9
Environment:	E3	E1	E5	P	E6	E7	E8	E2	E4
Binary weight:	2^2	2^0	2^4	P	2^5	2^6	2^7	2^1	2^3
USASCII bits:	b_3	b_1	b_5	P	b_6	b_7	Z	b_2	b_4

6.4.1 Bits $b_1 \ldots b_7$ correspond to the bit assignments in USASCII, USA Standard X3.4-1967.

6.4.2 Bit P is the parity bit. Character parity is odd.

6.4.3 Bit Z shall be zero and treated as a bit of higher order than the USASCII bits.

6.5 Block Length. (See Fig. 4)

6.5.1 ***Minimum 18 USASCII Characters.*** The tape mark is excluded from the minimum block length requirements and shall be a single-character block consisting of the Device Control Character, DC_3 ("1" bits in tracks 2, 3, and 8 only).

6.5.2 ***Maximum 2048 USASCII Characters.***

6.6 Gaps. (See Fig. 4)

6.6.1 ***Interblock Gap.***

(1) Nominal—0.6 inch.
(2) Minimum—0.5 inch.
(3) Maximum—25 feet.

(Gap depends upon the number of consecutive erase operations.)

6.6.2 ***Initial Gap.*** The gap between the trailing edge of the BOT marker and the first recorded character shall be 3-in. min, 25-feet max.

6.7 CRC Character. At the end of each tape block a character shall be written on tape for the possible recovery of single-track errors. This character shall be called the Cyclic Redundancy Check (CRC) character. In tape mark blocks, zero bits are written in all tracks for the CRC character.

6.7.1 Consider the contents of a 9-position register to be C_1 to C_9 with the following track assignments:

Regular position:	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9
Track number:	4	7	6	5	3	9	1	8	2

6.7.2 The CRC character shall be derived as follows.

6.7.2.1 All data characters in the tape block are added to the CRC register without carry (each bit position is exclusive OR'ed to C_n).

6.7.2.2 Between additions, the CRC register is shifted one position C_1 to C_2, etc, and C_9 to C_1.

6.7.2.3 If shifting will cause C_1 to become "1", then the bits being shifted into positions C_4, C_5, C_6, and C_7 are inverted.

6.7.2.4 After the last data character has been added, the CRC register is shifted once more in accordance with 6.7.2.2 and 6.7.2.3 above.

6.7.2.5 To write the CRC character on tape, the contents of all positions except C_4 and C_6 are inverted. The parity of the CRC character will be odd, if the number of data characters within the block is even, and even, if the number of data characters within the block is odd. The CRC character may contain all-zero bits in which case the number of data characters was odd.

6.8 LRC Character. Following the CRC character a check character shall be written for the possible detection of read errors. This character shall be called the Longitudinal Redundancy Check (LRC) character. A longitudinal check bit is written in any track if the longitudinal count is otherwise odd.

7. Revision of USA Standard Referred to in This Document

When the following USA Standard referred to in this document is superseded by a revision approved by the United States of America Standards Institute, the revision shall apply:

USA Standard Code for Information Interchange, X3.4-1967

Appendix A
Design Considerations

[These Appendixes are not part of USA Standard Recorded Magnetic Tape for Information Interchange (800 CPI, NRZI), X3.22-1967, but are included to facilitate its use.]

A1. Introduction

A1.1 This recorded magnetic tape standard is intended to implement the USA Standard Code for Information Interchange, X3.4-1967 (USASCII) or the latest revision, thereto on magnetic tape for interchange among information processing systems, communication systems, and associated equipment.

A1.2 A related standard will be prepared to specify unrecorded magnetic tape. The preliminary scope of the unrecorded magnetic tape standard covers the specification and testing of physical and magnetic properties and also the operation and storage environments, identification, and control devices and attachments. Establishment of a related "Unrecorded" standard will require a revision of this "Recorded" standard to incorporate any changes.

A1.3 A related standard will be prepared to specify a standard format for blocks recorded on ½-inch 9-track magnetic tape. The preliminary scope of the magnetic tape format standard covers the definition, content, functions, and interrelationships of blocks. Establishment of a related "Format" standard may require a revision of this "Recorded" standard to remove any duplication.

A1.4 Consideration will be given to:

(1) Definition of terms.

(2) Approaches permitting higher performance. The most common method used today is nonreturn-to-zero saturation recording. Consideration is being given to possible future use of other recording techniques such as phase modulation for future standards work.

A2. Specification Support

A2.1 Tape.

A2.1.1 The dimensions in the recorded tape standard are for reference and to facilitate the design and layout of the recording format.

A2.1.2 Quality testing and signal levels specification will be detailed in the unrecorded tape standard.

A2.1.3 The ½-inch tape width was selected due to its widespread and current usage throughout the industry and the large quantity in existence. Any changes would tend to make this ½-inch tape obsolete and also discourage the standard's acceptance. (Similar consideration applies to existing tape transport designs.)

A2.1.4 The maximum overall tape length has been specified and takes into consideration the maximum that can be handled by the reel specified. A minimum was not specified because it would unnecessarily restrict various interchange arrangements.

A2.1.5 Special leaders and trailers may be attached in order to meet the special transport loading and control requirements wherever needed.

A2.2 Reels.

A2.2.1 The reel as specified has an optimum outer diameter to inner diameter relationship for the tape specified. The reel specification encompasses those reels that presently exist in large quantities throughout the industry therefore eliminating forced obsolescence. The write-inhibit feature of this reel design has proven to be very efficient in use.

A2.2.2 The tape wind convention is specified to insure uniformity among all users.

A2.3 Recording Area Markers.

A2.3.1 The marker type and size are specified in the recorded tape standard so that placement of BOT and EOT could be determined and set forth in the standard. The detail of the marker will be set forth in the unrecorded tape standard.

A2.3.2 Recording area as depicted in Fig. 3 of the standard is to define the tested area and the maximum usable area for recording.

A2.4 Recording Method.

A2.4.1 NRZI is an accepted economical method of recording for the proposed density.

A2.4.2 DC erase of the full width of the tape is provided to ensure that all previously recorded information is removed prior to recording new information.

A2.4.3 Skew, in this document as in the comparable 9-track 800-NRZI ISO document, is the measurement of the deviation during read back in the control device from time coincidence of the bits within and/or between a recorded character(s) converted to apparent length to remove the speed dependence. Nomi-

nal values are used for character skew and character spacing rather than definite limits since there are probable measurement variations. The exact range of these variations is not necessarily the same for different equipments. Even though these variations exist, the 440 μ in. min apparent spacing between the last bit of a character and the first bit of the next character, as stated in the ISO document, is readily met by equipment meeting the requirements of this USA Standard.

"Nominally measured" and "Design center value" can be used interchangeably in a write quality check, in view of the above interpretation, and imply only that protection (not a specific design) is to be provided.

A2.5 Format.

A2.5.1 ***Number of Tracks.*** The 9-track format was selected for the following reasons:

(1) The defacto standard (7 track) is not capable of handling the USASCII code; a minimum of 8 tracks is required.

(2) The addition of the ninth track permits alternate, noninterchange uses of the same tape and equipment.

A2.5.2 ***Track Dimensions.***

A2.5.2.1 The track locations (centerline of recorded data) are dimensioned from the reference edge of the tape. Tracks are numbered 1 through 9 starting at this reference edge. The track location tolerance of $\pm$ 0.003 inch is close enough to prevent undesirably wide deviation in track locations, thus, allowing a read-head track width to provide adequate signal levels and enhance the freedom from defect-caused signal dropouts.

A2.5.2.2 The method of dimensioning allows equipment manufacturers to make distribution of design tolerances between the write head and the tape transport mechanism as desired.

A2.5.2.3 The minimum recorded track width was selected to provide maximum freedom from defect-caused signal dropouts consistent with reasonable head design practices.

A2.5.2.4 Width of read tracks is not specified. It is assumed that equipment manufacturers will select an optimum read track width for their particular equipment.

A2.5.3 ***Track Identification and Bit Assignment.***

A2.5.3.1 The track numbering is logically assigned 1 through 9 starting at the reference edge of the tape.

A2.5.3.2 The bit assignments were selected for maximum reliability and performance according to the following criteria:

(1) It is more probable that a "1" bit will be misinterpreted as a "O" bit than the converse.

(2) Errors as defined in (1) are more likely to occur near the edges of the tape than near the center.

(3) Certain portions of the code will be used more often than others. Most frequently used will be the numerics (0-9) and next in order will be the alpha characters.

A2.5.3.3 Based on these criteria the following bit assignment evolved:

(1) Bit Z was assigned to track 7. This bit will be used in non-USASCII code applications where the binary weight of 2^7 on track 7 is required. Compatibility with other 9-track systems, when recording binary information, is enhanced by this placement of bit Z.

(2) The parity bit is considered critical especially in double-numeric packing since it is possible to generate a configuration that consists of the parity bit only, namely "zero", "zero". It is anticipated that this configuration will happen frequently, therefore, P was placed near the center of the tape on Track 4.

(3) Bits 5 and 6 are critical because "1" bits are always present in the numerics. Therefore b_5 and b_6 were placed adjacent to P on Tracks 3 and 5, respectively.

(4) Since bit 7 is a "1" in all alpha characters, it is considered next in line and placed adjacent to b_6 on Track 6.

(5) Bits 3 and 4 are considered the least critical for the criteria above and, therefore, were placed on the two edge tracks, 1 and 9.

(6) Bits 1 and 2 are each "O" or "1" with equal probability and were, therefore, assigned the two remaining tracks, 2 and 8.

A2.5.4 ***Parity.***

A2.5.4.1 Odd character parity was selected so that the NULL character may be recorded on magnetic tape.

A2.5.4.2 The Longitudinal Check Character is automatically generated when the interblock gap magnetization direction is reestablished. Under certain circumstances all bits of the check character will be "O's".

A2.5.5 ***Block Length.***

A2.5.5.1 The minimum block length was selected to minimize the possibility of misin-

terpretation of spurious signals within the interblock gaps.

A2.5.5.2 The maximum block length was selected to permit processing on the smallest systems and accommodation by reasonably sized buffers.

A2.5.5.3 Although the Longitudinal Check Character and the Cyclic Redundancy Character are part of any block, neither is considered to be an information row character and is not included in the statement of block length.

A2.5.5.4 The DC_3 character, when used in the single-character block, acts as a Tape Mark for control of the tape handling mechanism. This does not preclude use of DC_3 as a datum within the context of non Tape Mark blocks.

A2.5.6 ***Gap Sizes.*** Gap sizes are specified according to existing usage. The maximum gap is specified to permit corrective action when gaps of excessive length are encountered (successive erase instructions).

A3. Additional Considerations

A3.1 Introduction. With the standard objective in mind, i.e., to provide interchange between systems utilizing digital magnetic tapes, the proposed standard provides sufficient specifications to facilitate such interchange, yet provides considerable flexibility for purposes inherent within any given systems design. The following are feasible possibilities.

A3.2 Noninterchange Applications.

A3.2.1 Increased character transfer rate:

(1) Density—no restrictions on any other recording technique.

(2) Tape speed—no restriction.

(3) Packing —two numeric characters may be placed in one tape character, possibly by the use of Track 7 for one of the bits in a numeric character.

A3.2.2 Further flexibilities allowed by 9 tracks, for example:

(1) Redundant recording.

(2) Search indexes.

(3) Special control.

A3.3 Information Exchange Flexibility.

A3.3.1 The USASCII concept predicates a variety of inherent subsets and supersets. This USA Standard for recorded magnetic tape will accommodate this flexibility.

A3.3.2 Present equipment design and handling capability was given considerable weight in choice of the particular standard attributes.

A3.3.3 Upon agreement between persons interchanging recorded tapes, nothing in this specification should be taken to prohibit longer block lengths than that specified in this standard.

A3.4 A Technique for Improving Probability of Successful Interchange of Recorded Tapes. The following technique may be used to enhance the successful reading of tapes recorded in accordance with 5.3, Skew.

A long block of consecutive characters containing all "ones" may be recorded after the end of data which will allow readjustment of the static skew of the reading transport with respect to the static skew of the writing transport.

Appendix B
Cyclic Redundancy Character (CRC)

When reading, the CRC register is controlled as it was for writing until the last data character has been added and the final shift made. The CRC character on tape is then added to it.

To test for an error, the register is read out inverting all positions except C_4 and C_6. If the masked output of any position is a "one", an error has been detected.

To determine whether the errors occurred in a single track and, if so, which, an Error Pattern (EP) must be generated. This pattern must then be compared with the error indicating pattern in the CRC register.

Consider the contents of a 9-position EP register to be E_1 to E_9 corresponding to C_1 to C_9 of the CRC register. The error pattern may be constructed as follows:

(1) Whenever a character parity error is detected for a data character or CRC character, a one is added without carry to E_9 (1 exclusive OR'ed to E_9).

(2) Between the reading of characters the EP register is shifted one position E_1 to E_2, etc, to E_9 to E_1.

(3) if shifting will cause E_1 to become "1", then the bits being shifted into positions E_4, E_5, E_6, and E_7 are inverted.

To determine the track in error, a series of comparisons is made between the contents of the EP register and the CRC register. The CRC register read out through the mask, which inverts all positions except C_4 and C_6, is compared with the EP register.

The first comparison is direct: E_1 to C_1, E_2 to C_2, etc. If all positions match, the error was in the track associated with C_9 (Track 2).

The CRC register is then shifted once, according to the rules in 6.7.2.2 and 6.7.2.3, between each comparison. This is continued until a match is obtained or until a maximum of nine comparisons (eight shifts) have been made. The track in error corresponds to C_9 through C_1 for a match on the first through ninth comparisons, respectively.

There are two conditions for the final contents of the CRC register for which an uncorrectable error has been detected and for which an incorrect track in error indication will be obtained if comparisons are made. These are:

(1) C_1 through C_9 all zero

(2) C_4 and C_6 zero, all other positions containing "one" (the read-out mask)

Comparisons must not be made when either of these two conditions exists.

If a track in error indication is obtained, the error block may be re-read. The output of the track in error is then inverted whenever the parity of a character is incorrect.

USA Standards

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Computers and Information Processing

X3.1-1962	Signaling Speeds for Data Transmission
X3.2-1963	Print Specifications for Magnetic Ink Character Recognition
X3.3-1963	Bank Check Specifications for Magnetic Ink Character Recognition
X3.4-1968	Code for Information Interchange
X3.5-1968	Flowchart Symbols and Their Usage in Information Processing
X3.6-1965	Perforated Tape Code for Information Interchange
X3.9-1966	FORTRAN
X3.10-1966	Basic FORTRAN
X3.11-1966	Specifications for General Purpose Paper Cards for Information Processing
X3.12-1966	Vocabulary for Information Processing
X3.13-1966	Parallel Signaling Speeds for Data Transmission
X3.14-1969	Recorded Magnetic Tape for Information Interchange (200 CPI, NRZI)
X3.15-1966	Bit Sequencing of the USA Standard Code for Information Interchange in Serial-by-Bit Data Transmission
X3.16-1966	Character Structure and Character Parity Sense for Serial-by-Bit Data Communication in the USA Standard Code for Information Interchange
X3.17-1966	Character Set for Optical Character Recognition
X3.18-1967	One-Inch Perforated Paper Tape for Information Interchange
X3.19-1967	Eleven-Sixteenths Inch Perforated Paper Tape
X3.20-1967	Take-Up Reels For One-Inch Perforated Tape For Information Interchange
X3.21-1967	Rectangular Holes in Twelve-Row Punched Cards
X3.22-1967	Recorded Magnetic Tape for Information Interchange (800 CPI, NRZI)
X3.24-1968	Signal Quality at Interface Between Data Processing Terminal Equipment and Synchronous Data Communication Equipment for Serial Data Transmission
X3.25-1968	Character Structure and Character Parity Sense for Parallel-by-Bit Data Communication
X3.26-1969	Hollerith Punched Card Code

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